



Armed Forces College of Medicine AFCM



Deglutition

By

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INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

- ✓ **Describe the mastication reflex**
- ✓ **List its functions**
- ✓ **Explain how food is swallowed and transferred to the stomach**
- ✓ **List the functions of the upper and lower esophageal sphincters**
- ✓ **Explain how the lower esophageal sphincter is controlled**
- ✓ **Describe regulation of esophageal motility**
- ✓ **Apply knowledge to solve clinical problem**

Chewing (= Mastication)



It is the act of grinding & mixing of food by the teeth

The act of chewing can be voluntary (**fifth cranial nerve**) but, most chewing is a rhythmic reflex (=Involuntary = **Chewing reflex**)



The purposes of chewing:

- ✓ Break food up into smaller pieces → **facilitate swallowing**
- ✓ Mix food with saliva → **facilitate digestion & swallowing**
- ✓ Stimulate the taste buds → **satiety & reflex ↑ digestive**

Swallowing (Deglutition)



It is the process by which a bolus of food moves from the mouth into the stomach

Swallowing starts voluntarily, then it is under **reflex control**

(= once it is initiated, it can not be stopped)

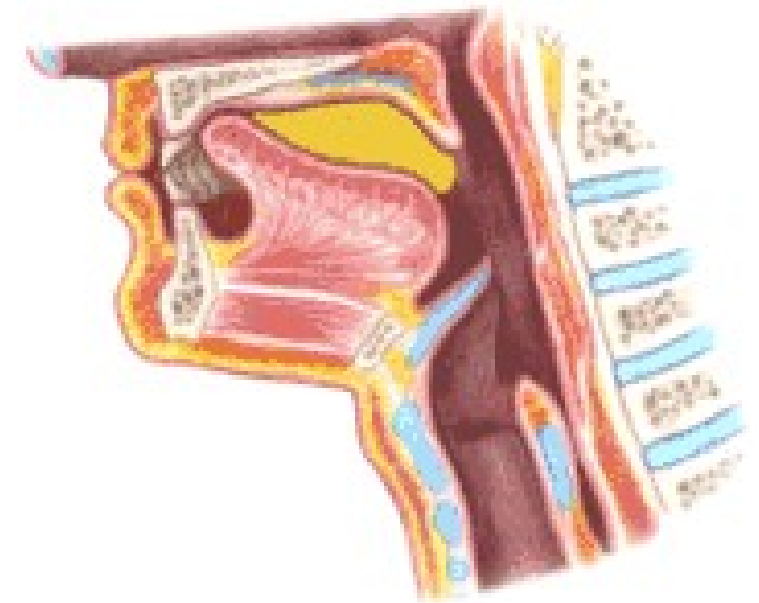
Mechanism of Swallowing

3 stages:

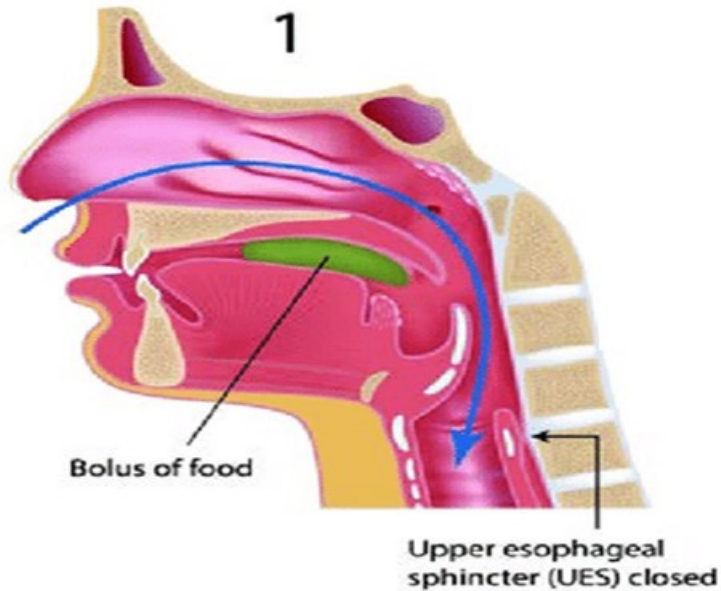
1- Oral

2- Pharyngeal

3- Esophageal

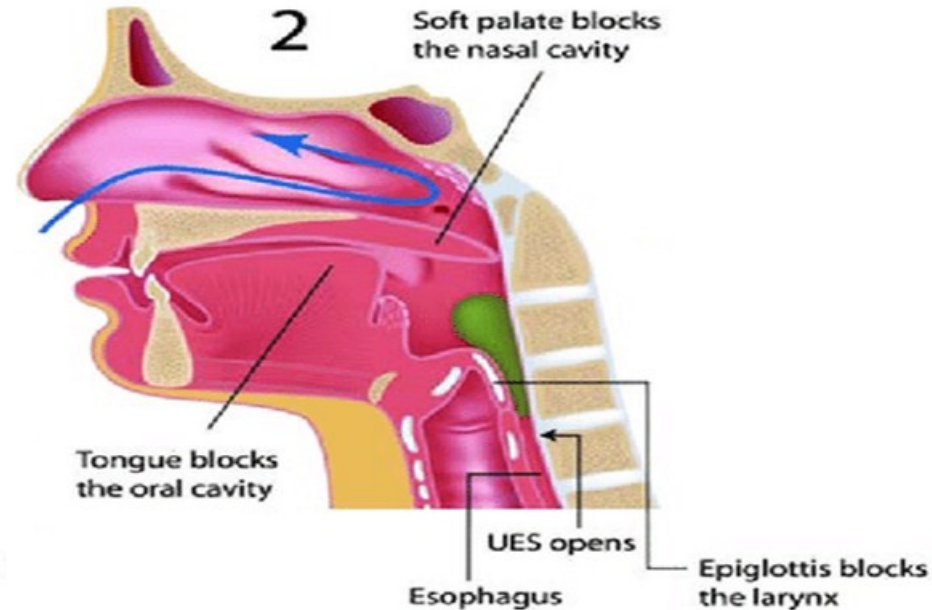


Stages of Swallowing



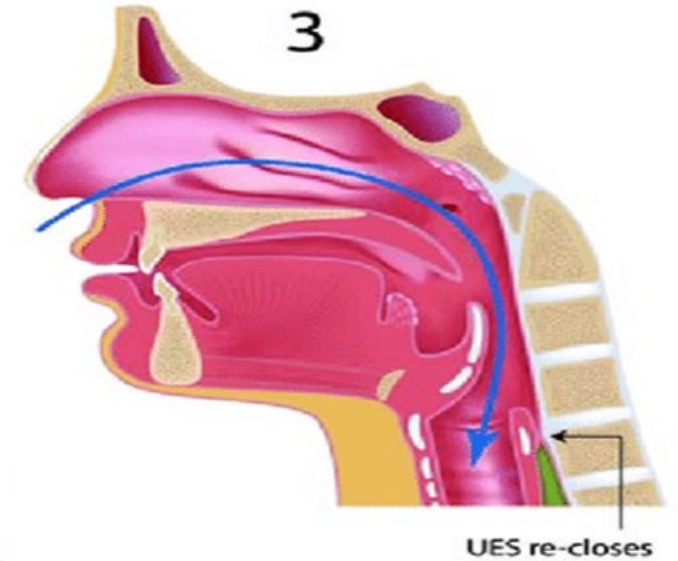
Oral stage

Food bolus is passed from mouth to pharynx



Pharyngeal stage

Involuntary passage of bolus through the pharynx into esophagus



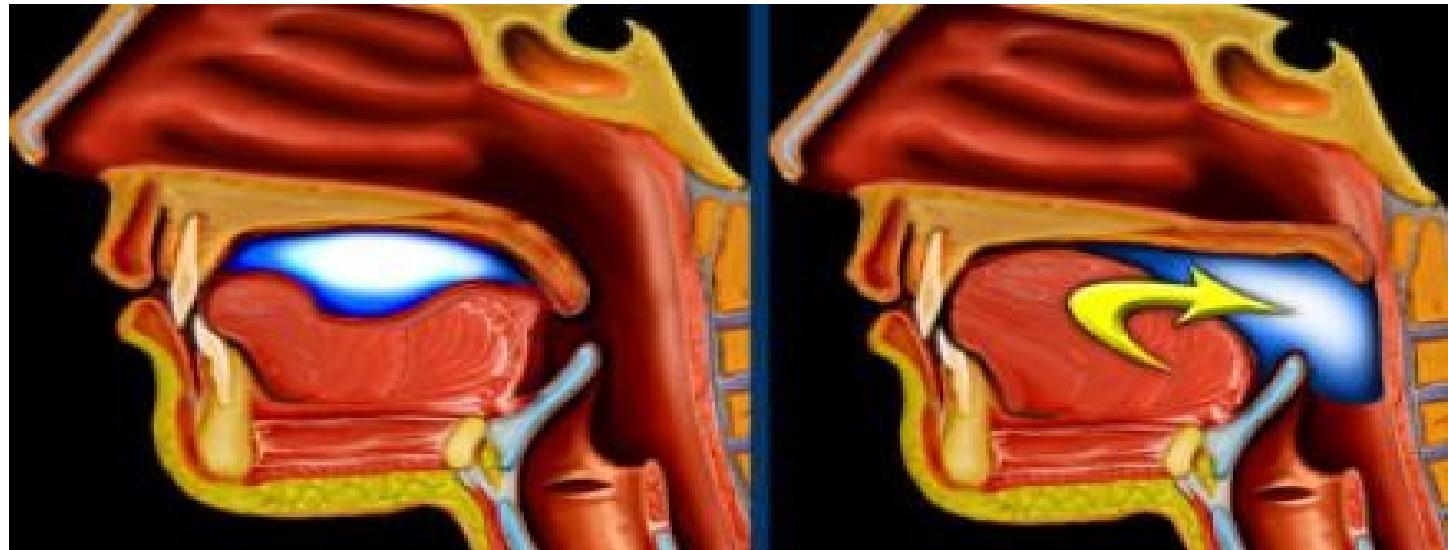
Esophageal stage

Involuntary passage of bolus from esophagus to stomach

1) Oral Stage of Swallowing



**Voluntary
stage**



*** Food bolus is passed from mouth to pharynx
(*by upward and backward movement of tongue against
the palate*)**

2) Pharyngeal Stage of Swallowing



Involuntary stage

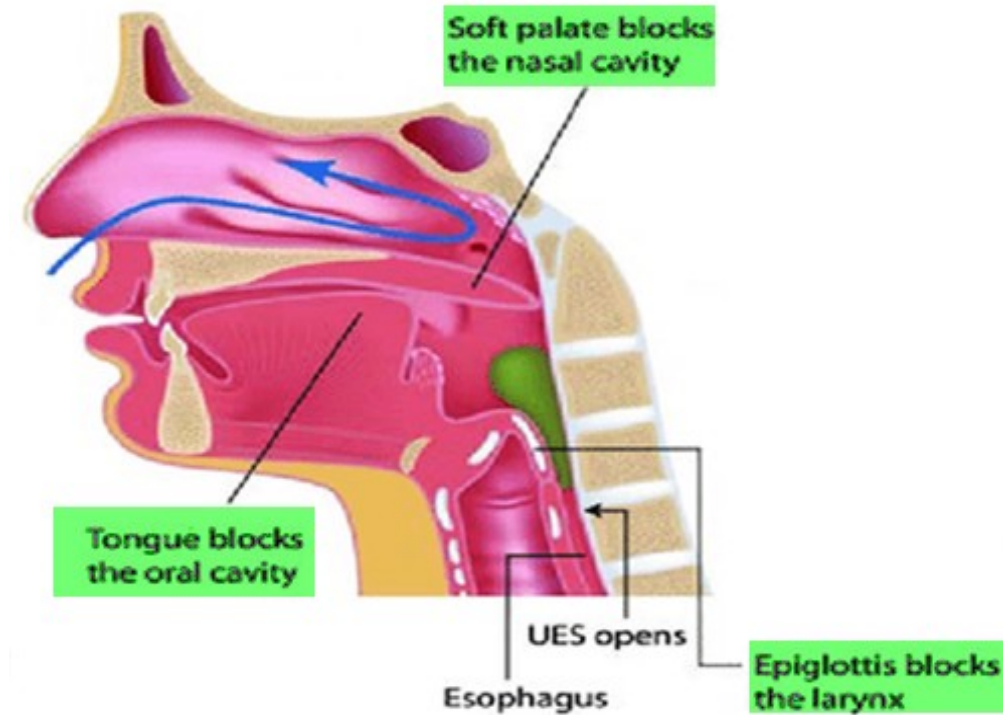
Bolus of food enters the pharynx

Stimulates swallowing receptor

Reflex act
impulses pass to Deglutition Center
In medulla & Lower Pons

Initiate a series of automatic pharyngeal muscular contractions

propels the food into the esophagus

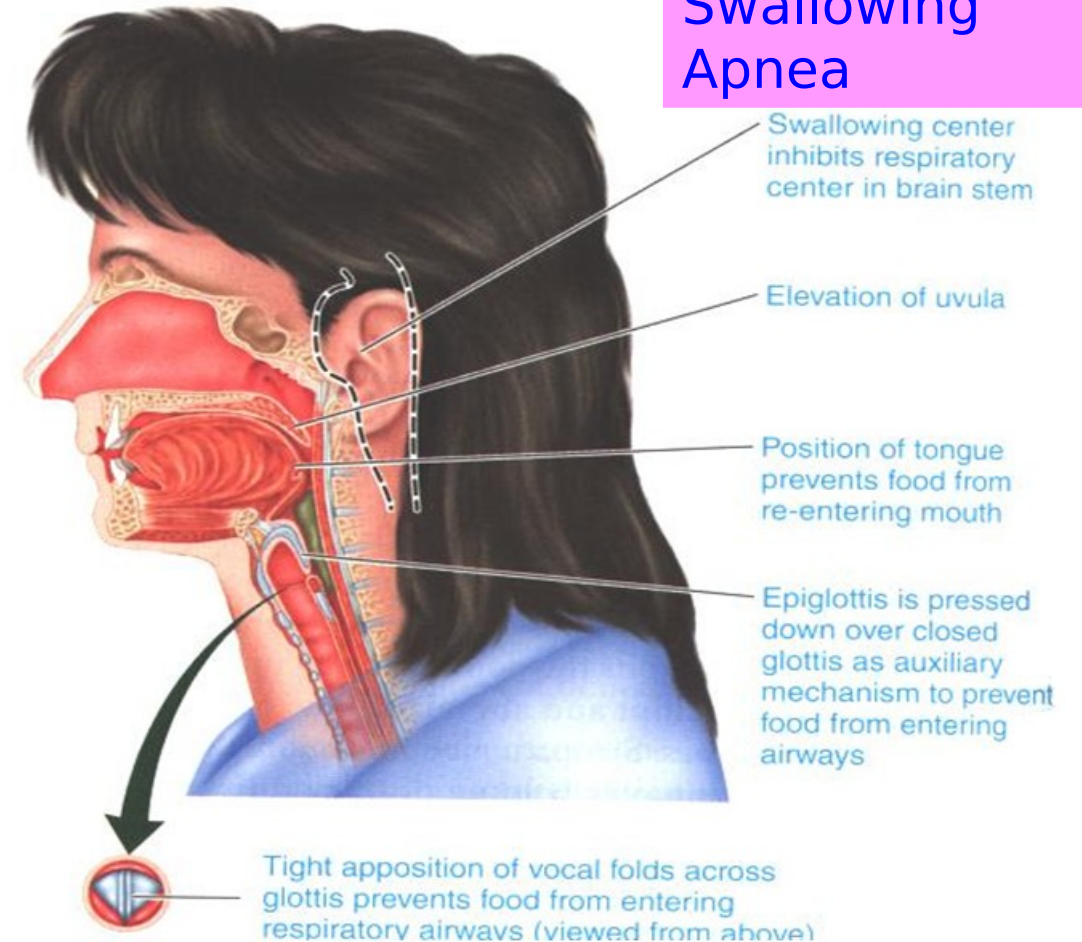
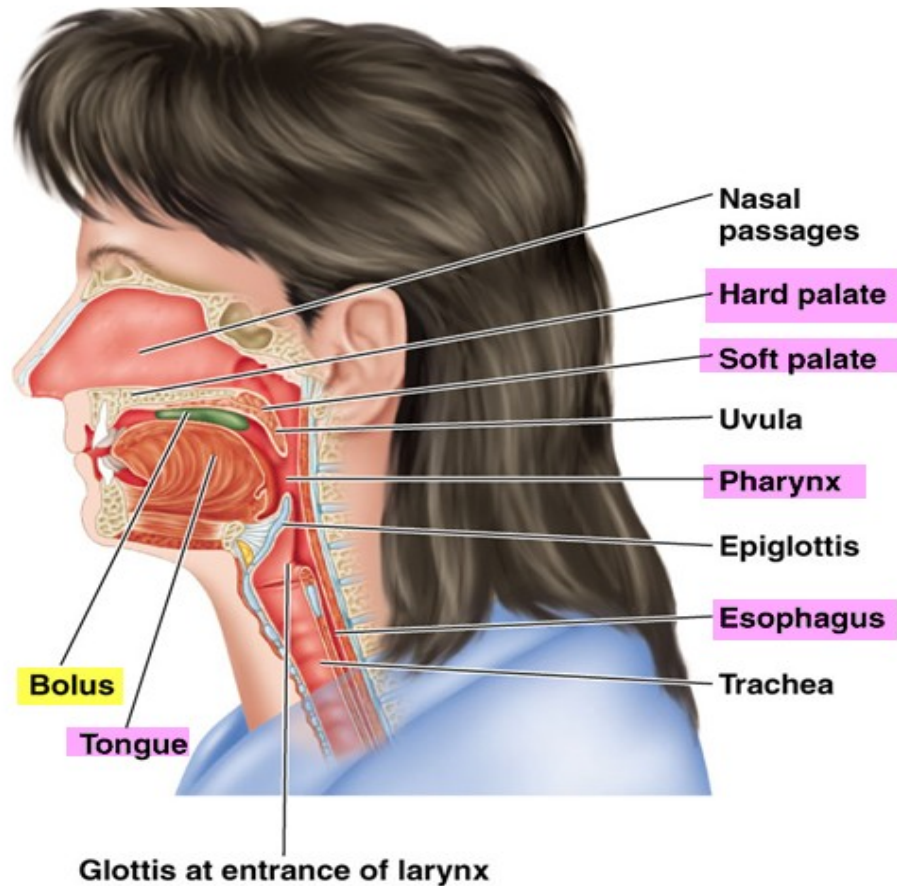


**Respiratory passages are closed & respiration is inhibited
(protective reflexes)**

2) Pharyngeal Stage of Swallowing



Protection of air passages during swallowing occurs as follow:



2) Pharyngeal Stage of Swallowing



Protective reflexes during pharyngeal phase of swallowing:

- ✓ **Elevation of the soft palate**
Preventing food reflux into the nasal cavities
- ✓ **Elevation of the larynx against the epiglottis**
- ✓ **Approximation of the vocal cords**
- ✓ **Downward movement of the epiglottis to cover the closed glottis**
Preventing food entrance into the trachea
- ✓ **Temporary apnea:**
Stopping respiration at any point in its cycle to allow swallowing to proceed

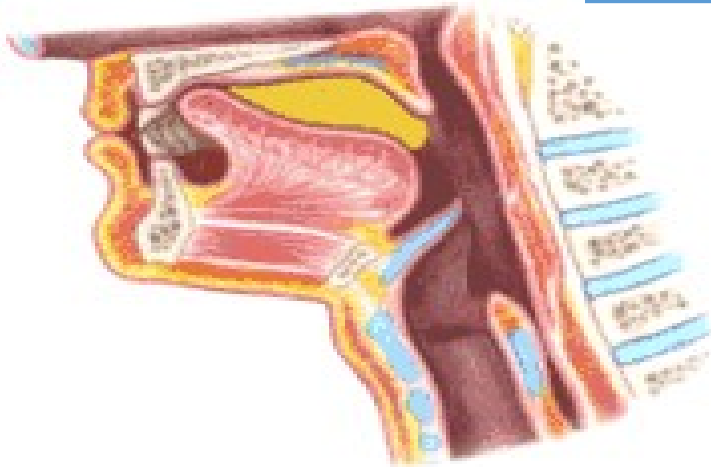


2) Pharyngeal Stage of Swallowing



Swallowing
Apnea

**1 - 2 seconds
interrupting respiration**



**Respiratory center of the
medulla**

**The swallowing center inhibits the respiratory center
during this time**

3) Esophageal Stage of Swallowing



Involuntary stage

Propulsion of food through esophagus is done by 2

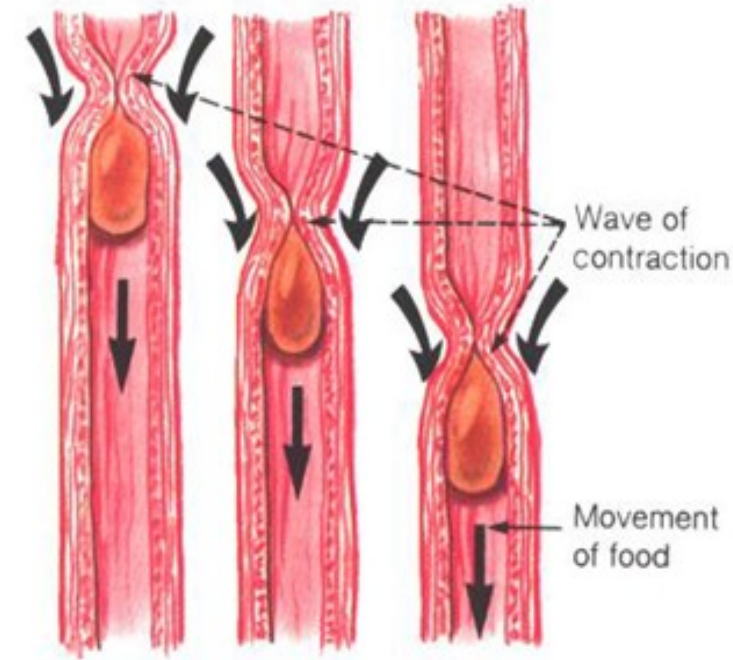
Esophageal peristaltic movements

Primary peristalsis

= Continuation of peristaltic wave that started in the pharynx & spreads into the esophagus during the pharyngeal stage of swallowing

Secondary peristalsis

It results from esophageal distention by the retained food, and they continue until all the food has emptied into the stomach



If it fails to move all food that has entered the esophagus into the stomach

3) Esophageal Stage of Swallowing



Secondary peristaltic waves:

- Continue until all food has emptied into the stomach

- Are initiated

✓ Partly by a **local reflex** in the esophageal myenteric nerve plexuses

✓ Partly by **reflexes** transmitted between the esophagus & medulla through **vagal nerve fibers**

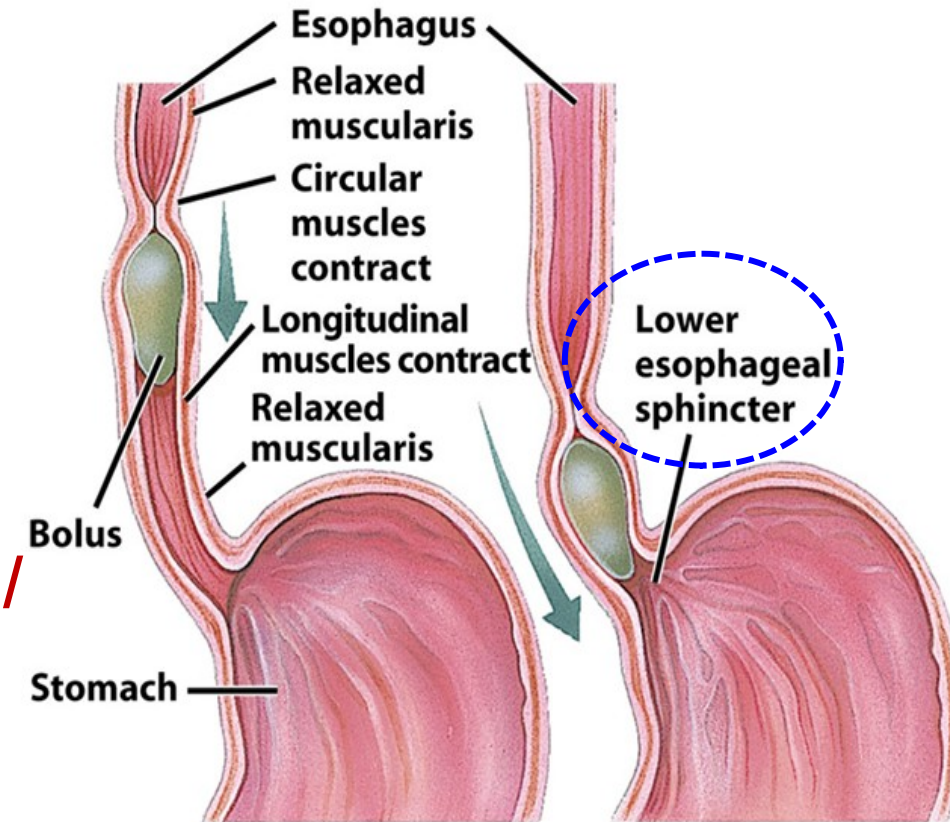


Figure 24-10c Principles of Anatomy and Physiology, 11/e
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Lower Esophageal Sphincter (LES)

(= *Gastro-esophageal Sphincter*)



It is made up of 3 components

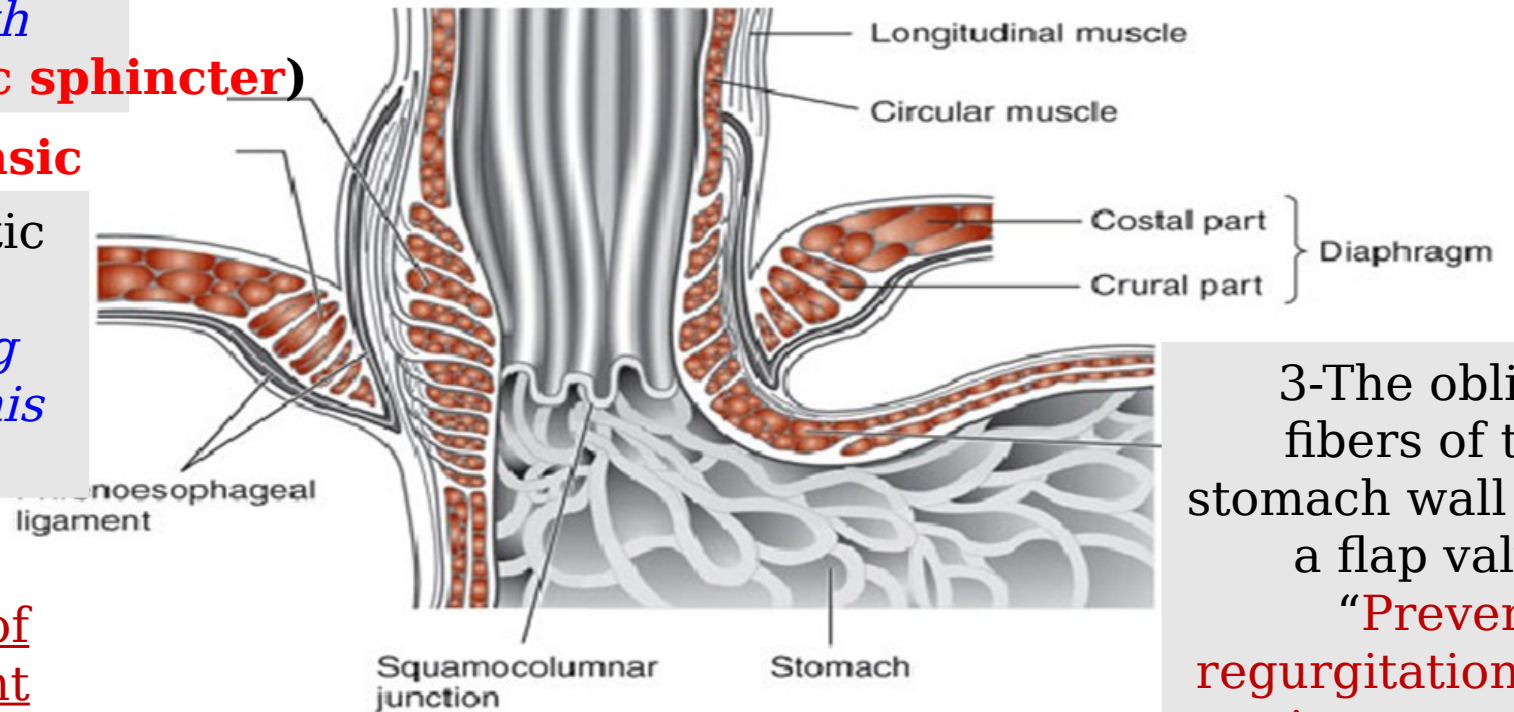
1-Esophageal smooth muscle "*Prominent at the junction with stomach*"

(**Intrinsic sphincter**)

(**Extrinsic**

2-Diaphragmatic fibers
"*Surrounding esophagus at this point*"

Together permit orderly flow of food into the stomach & prevent reflux of gastric contents into the esophagus



3-The oblique fibers of the stomach wall create a flap valve
"**Prevent regurgitation when intragastric pressure rises**"

Lower Esophageal Sphincter (LES)

(= *Gastro-esophageal Sphincter*)

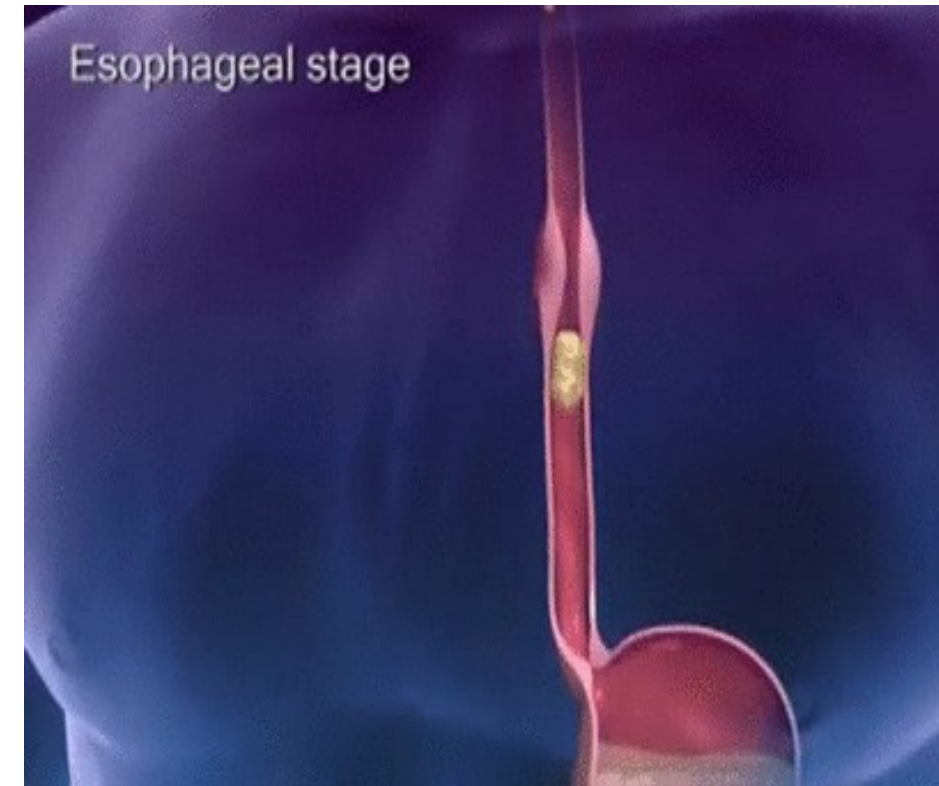


- LES remains tonically
- **ONLY** contracted when a peristaltic swallowing wave passes down the esophagus,



"Receptive Relaxation"

relaxes LES ahead of the peristaltic wave & allows easy propulsion of food into the stomach



Lower Esophageal Sphincter (LES) (= *Gastro-esophageal Sphincter*)



Tone of LES is under neural control

Acetylcholine
“Excitatory”

Nitric oxide (NO) & VIP
“Inhibitory”

Between meals the normal tonic activity of LES prevents reflux of stomach contents into the esophagus

Abnormalities of LES tone

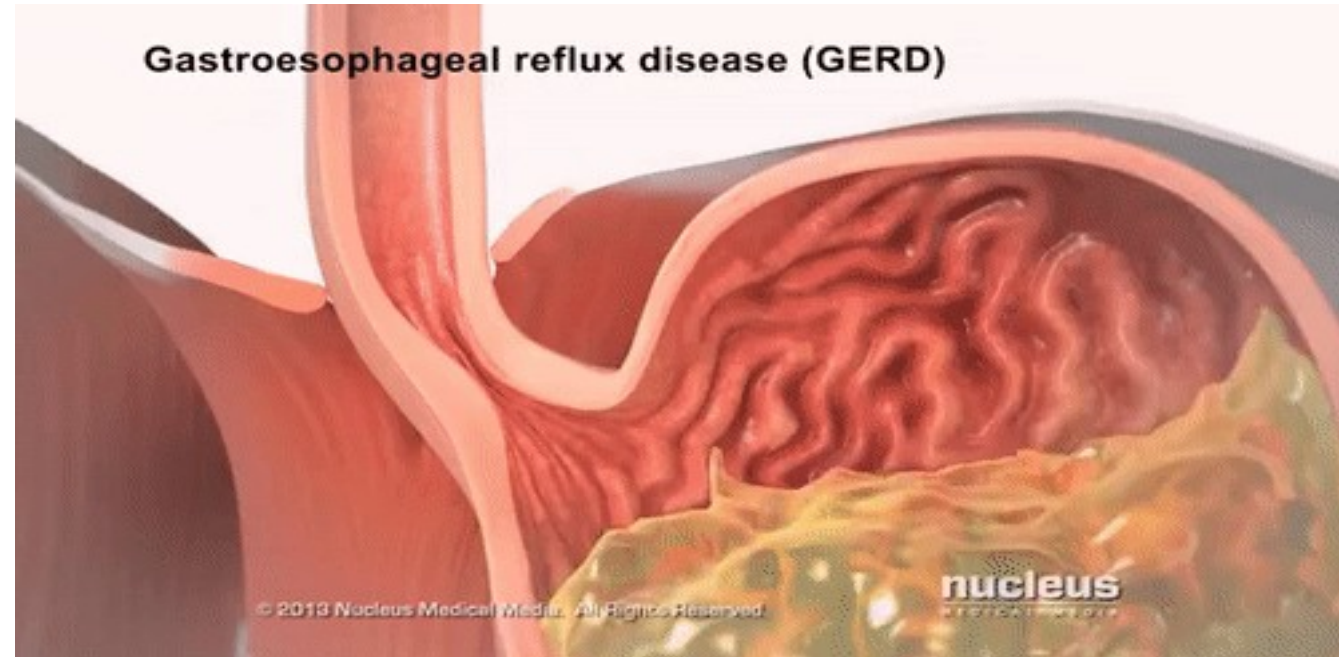


1 Gastroesophageal Reflux

↓ Resting tone of LES →

✓ e.g. During pregnancy
(due to high level of progesterone)

✓ e.g. Diet with high
sugar & fat may lead to
heartburn



Heartburn

Oesophagiti
s

Ulceration
of
esophagus

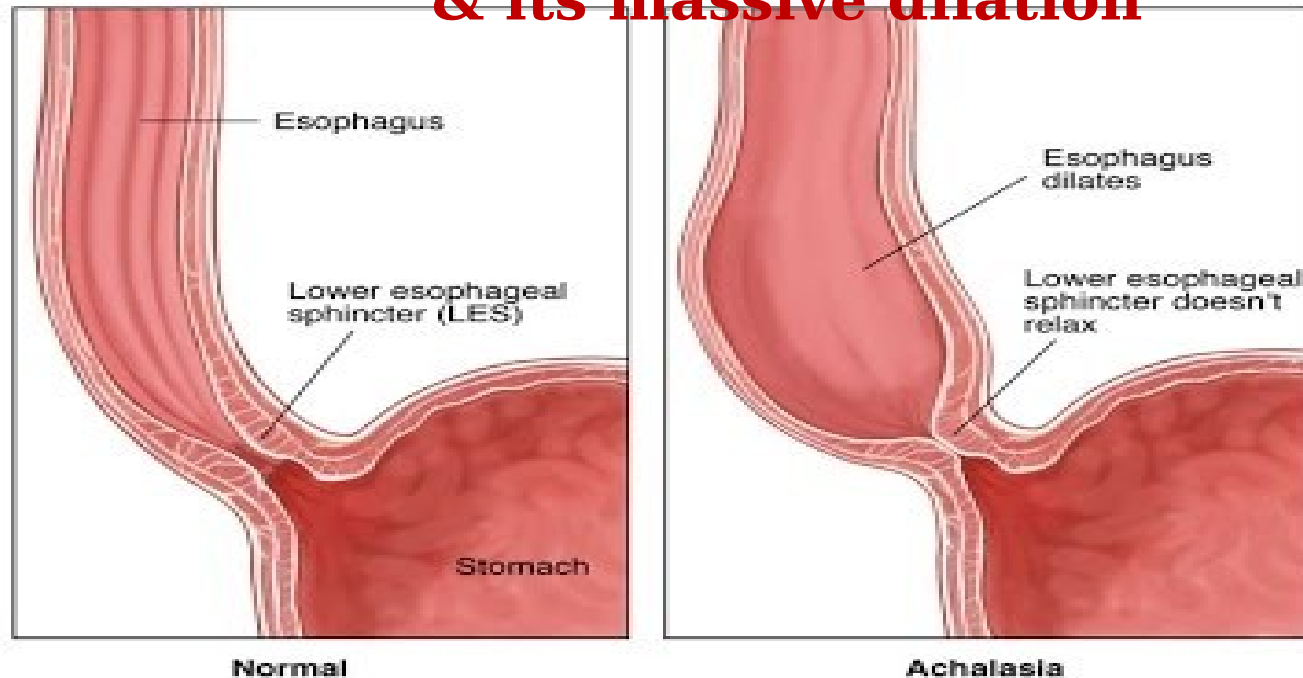
Stricture
of
esophagus

Abnormalities of the tone of LES



2 Achalasia:

It is incomplete relaxation of LES → Accumulation of food in esophagus & its massive dilation



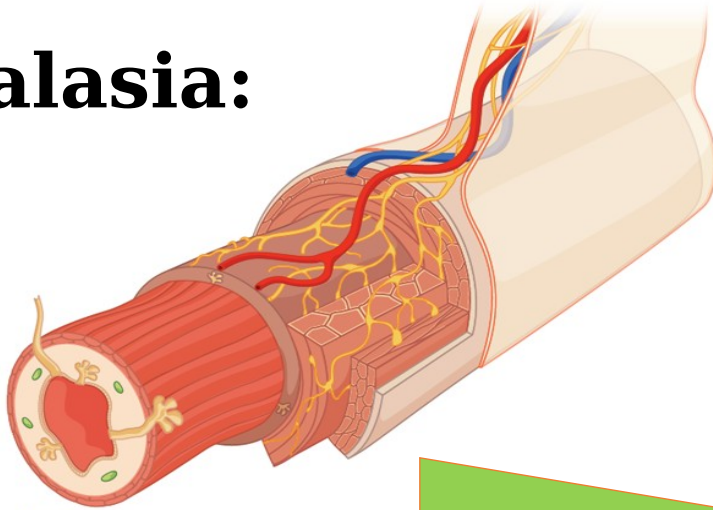
It is due to damage to myenteric nerve plexus in the region of LES □

decrease NO and VIP

Abnormalities of the tone of LES



2 Achalasia:



Defect at the LES
(*Enteric Nervous System*)



Defective release of NO & VIP

•Dilation of the sphincter

•Esophageal muscle incision

•Injection of botulinum toxin in LES to inhibit acetylcholine release

Treatment

Summary



- ✓ Swallowing is initiated **voluntary** in mouth, thereafter it is under **involuntary** or **reflex control**
- ✓ The reflex is coordinated by **swallowing center** in the **medulla**
- ✓ The UES and LES are **closed** and **open only** during swallowing
- ✓ Swallowing ends by entry of the bolus of food into the stomach



Question 1

Which of the following is the major stimulus for secondary peristaltic waves in the oesophagus?

- a) Esophageal distention by food
- b) Presence of food in pharynx
- c) Regurgitation of food from stomach
- d) Closure of UES
- e) Opening of LES



Question 2

Achalasia of the cardia is due to defect in which of the following?

- a) Medulla oblongata
- b) Vagus nerve
- c) Enteric nervous system
- d) Smooth muscle of lower 2/3 of the oesophagus
- e) Skeletal muscles of upper 1/3 of the oesophagus

SUGGESTED TEXTBOOKS



- 1. Guyton and Hall.** *Text book of Medical Physiology, 13th Edition*
- 2. Ganong's** *Review of Medical Physiology, 25th Edition*
- 3. Sherwood.** *Human Physiology From Cells to*

